



NORTHSTAR PROPRIETARY & CONFIDENTIAL INFORMATION

NorthStar

Nuclear Decommissioning Company, LLC

NorthStar VTY Decommissioning



Vermont Yankee Nuclear Power Station

- | | | | |
|---|----------------------------------|-----------------------------------|--------------------------------------|
| 1. Turbine | 21. New fuel storage vault | 41. Intercept valve | 61. Recycling and stores |
| 2. Main steam lines | 22. Overhead crane | 42. Moisture separator | 62. Elevator |
| 3. Recirculation pump | 23. Biological shield well | 43. Main condensers | 63. Turbine building |
| 4. Inboard main steam isolation valve | 24. Steam dryer | 44. Cooling water recirculation | 64. Rad waste building |
| 5. Outboard main steam isolation valve | 25. Steam separator | 45. Turbine oil tank | 65. Condensate phase separator tanks |
| 6. Downcomers | 26. Fuel assemblies | 46. Emergency diesel generators | 66. Centrifuge |
| 7. Shield plug | 27. Reactor vessel | 47. Overhead crane | 67. Cask filling area |
| 8. Dryer/separator storage pool | 28. Vessel head | 48. Condensate storage tank | 68. Spent resin tank |
| 9. Reactor building cooling water heat exchangers | 29. Main steam outlet | 49. Feedwater pump | 69. Waste sludge tank |
| 10. Reactor building cooling water pump | 30. Recirculation water outlet | 50. Control room | 70. Traveling hoist |
| 11. Reactor water cleanup heat exchanger | 31. Uninterruptible power supply | 51. High pressure heaters | 71. Sample tanks |
| 12. Reactor water cleanup pump | 32. Main transformer | 52. Main stop valve | 72. Surge tank |
| 13. Vital AC motor generator set | 33. Ring header | 53. Turbine lube oil storage tank | 73. Discharge structure |
| 14. Recirculation motor generator set | 34. RHR service water pump | 54. Exclusion cubicle | 74. Low pressure heaters |
| 15. Fuel pool (spent fuel storage) | 35. Recirculation inlets | 55. Main generator leads | 75. Intake structure |
| 16. Spent fuel rack | 36. Manifold | 56. Make-up demineralizers | 76. Advanced off-gas building |
| 17. Hydraulic control units | 37. Feedwater inlet | 57. House heating boiler | 77. West cooling tower |
| 18. Standby gas treatment | 38. Generator | 58. Clearwell | 78. East cooling tower |
| 19. Primary containment wall | 39. Low pressure turbine | 59. Acid storage tank | 79. Spray pond |
| 20. Refueling bridge | 40. High pressure turbine | 60. Caustic storage tank | 80. Warehouse |

NDCAP Presentation

Vermont Yankee
May 20th, 2019

Abatement & Demolition | Emergency & Disaster Response | Environmental Remediation | Nuclear Decommissioning

Update on Decommissioning Status



Re-cap and Update from January Meeting:

Major Near Term Work/1st Phase/Critical Path Items:

- Refuel Floor Alignment **COMPLETE**
- Crane/Material Handling equip (design/fab/checks) **COMPLETE**
- Spent Fuel Pool Clean Out/Rack Removal **COMPLETE**
- Vessel Re-flood and Preparation **COMPLETE**
- Drywell tooling set up/testing & placement **ON-GOING**

Project Schedule – Overview (Re-Cap)

	NorthStar Ownership (Target 01.11.2018)			Partial License Termination (Target 12.31.2026)								License Termination (Est. 12.31.2052)	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027 to 2051	2052
													Final Site Restoration & License Termination
Dry Fuel Storage Program (Fuel on ISFSI - Dec. 31, 2018)	Completed by Entergy												
Large Component Removal (RPV, RPVI, etc.)		Engineering & Planning		Complete - March 2022									
Decontamination & Decommissioning		Pre-Closing Work		Complete - December 2026									
Spent Fuel Management				ISFSI Operations and Management (2019 thru 2026)								ISFSI Only Operations Period (2027 thru DOE Fuel Pick-up)	

Overall Schedule:

- Critical Path
 - Large Component
 - RVI/RV Segmentation – 2019 to 2020
 - Large Components – 2019 - 2022
- D&D
 - with Short Term Schedule Targets and Optional Work 2019 - 2026
- Spent Fuel Storage – ISFSI Management

Priorities/Upcoming Efforts/Projects

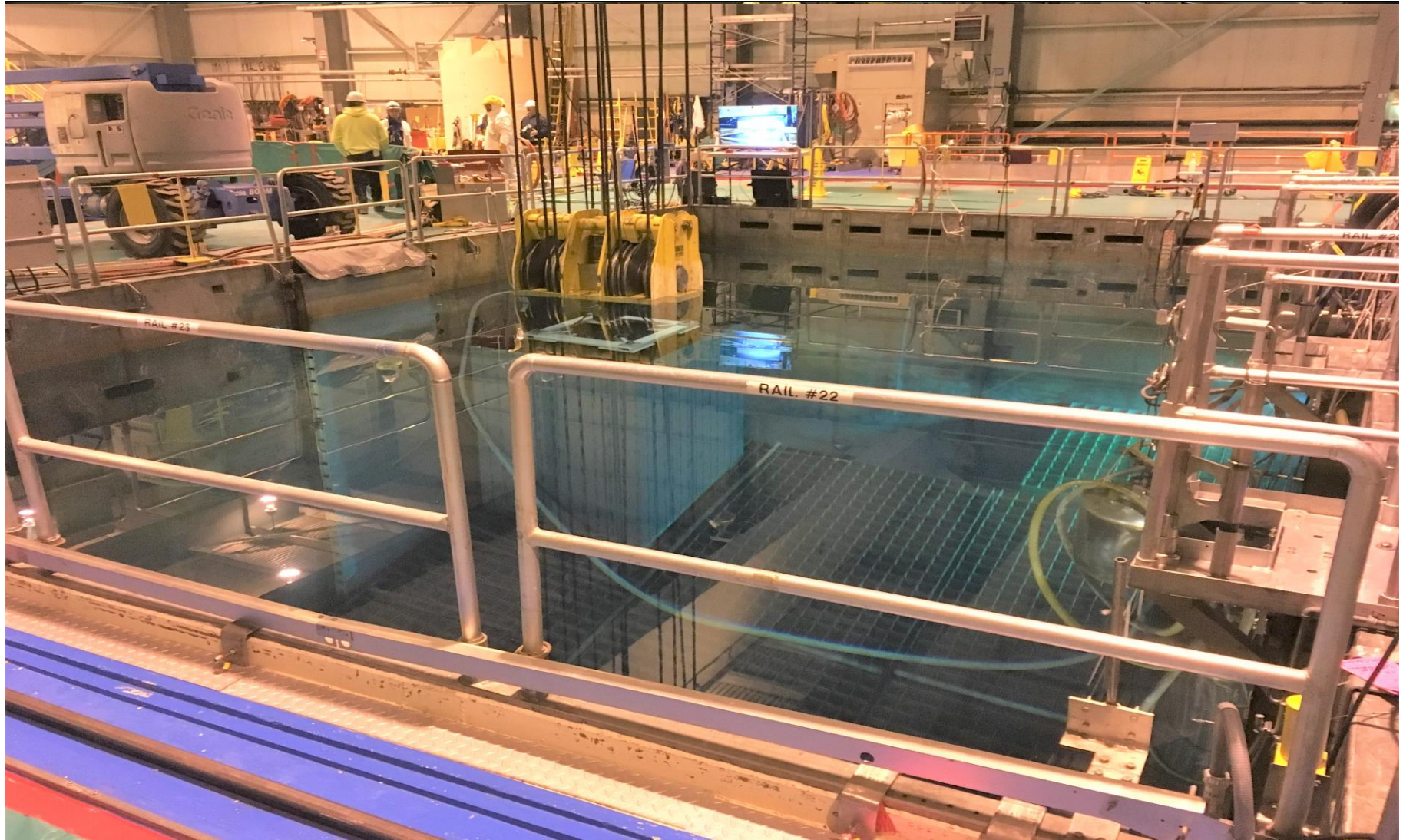
Additional Short Term Schedule Targets and Optional Work in 2019:

- Streamline – Systems and Processes **COMPLETE**
- Schedules blended and optimized to support Vessel work, abatement/component removal **COMPLETE**
- Ensuring Environmental Memorandum Of Understanding commitments met **ONGOING** (working to July 11th deadline with ANR, some sampling and characterization already in progress)
- Facility Management –minor infrastructure changes for access control (safety) **ONGOING**
- Infrastructure
 - New rail spur **COMPLETE**/ Temp Bldg erection **ONGOING**
 - ORANO Container Pad **COMPLETE** RWC Horizontal Storage Structure **ONGOING**
- COB demolition **COMPLETE**
- Cooling Towers demolition **PREPPING** (ready to commence after abatement)
- Turbine Building (Targets of Opportunity/Still in Plan/Prep/Assess phase)
 - Abatement / Large Component Removal (Turbine/Generator/Main Transformer, etc.)

Containment Head removal for segmentation



Rack Removal Operations in Spent Fuel Pool



Reactor Vessel Segmentation

GE BWR Mark I Reactor Vessel

5 ½" thick forged carbon steel walls, clad with stainless steel

55' height (not including head)
17' internal diameter

10 ½" thick and 22" tall at flange

Reactor Head alone 60 tons

Reactor Vessel approx. 390 tons



Select components within will be cut up and packaged for storage at the ISFSI within a Cask similar to that in which the Spent Fuel is stored.

These select components have been carefully evaluated, due to their high activation levels, and are designated as Greater Than Class C (GTCC) waste.

RV Closure Head

Steam Dryer

Steam Separator

Upper Core Grid

Guide Tubes

Core Plate Assembly

Shroud Cylinder

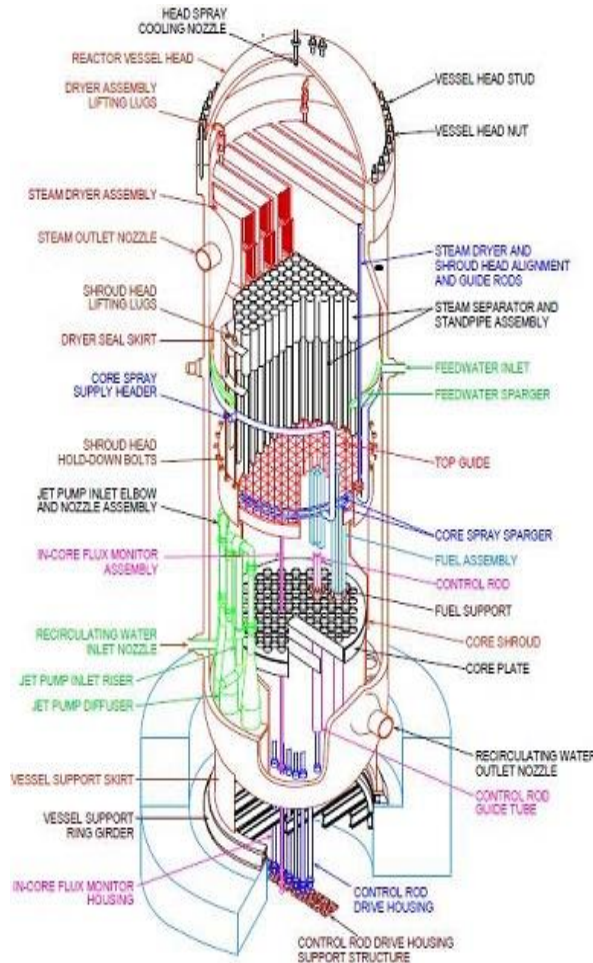
Jet Pump Assemblies

RV Nozzles

Reactor Vessel

GE BWR Mark I Reactor Internals

- 3-D Modeling of reactor and associated components allows optimization of cutting and packaging plans
- Specialized tooling of multiple varieties will be used for cutting process
- Cutting and packaging work is broken into “sequences”
- Generally activities will start at the top of the vessel and work downward



- 17 Custom Boxes will be used of 11 different sizes
- Precise geometries will be obtained during cutting
- Most cutting operations will be performed underwater
- Many vessel components already removed (fuel, control rods, instrumentation, etc)

RV Closure Head

Steam Dryer

Steam Separator

Upper Core Grid

Guide Tubes

Core Plate Assembly

Shroud Cylinder

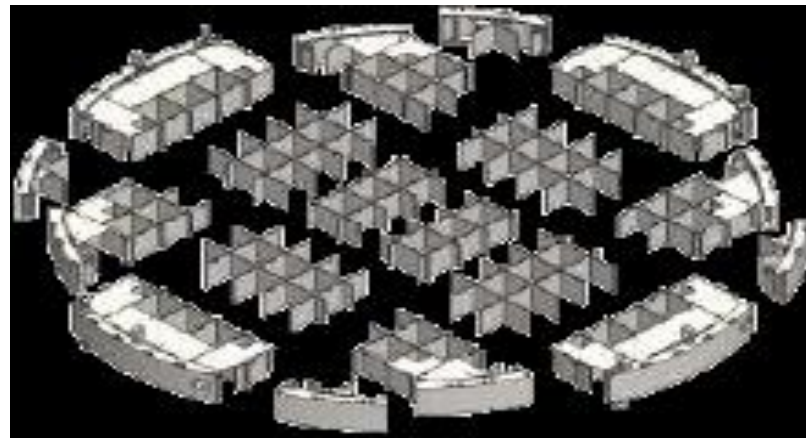
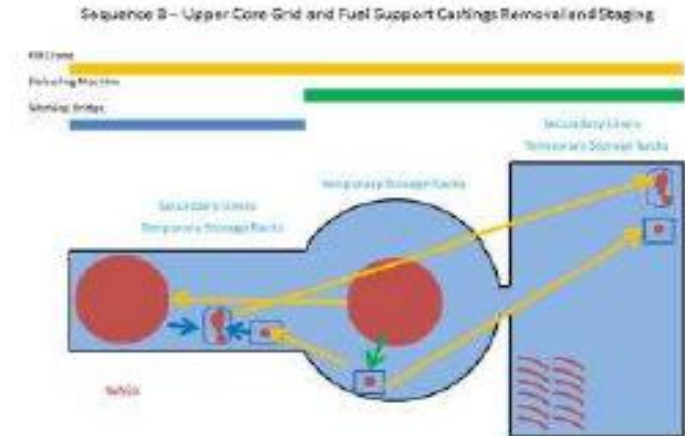
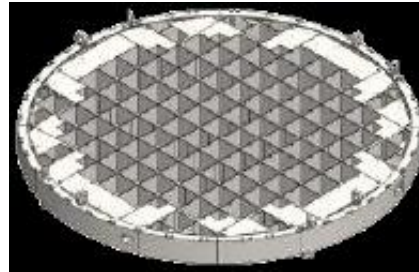
Jet Pump Assemblies

RV Nozzles

Reactor Vessel

Example of Sequenced segmentation

- **SEQUENCE 8:** Upper Core Grid (UCG) removal and staging
- UCG Grid segmented by WASS PCS in D/S Pit, then placed in GTCC 'baskets' and transferred to SFP for temp storage



(Each segmented pieces are predestined for a specific container based on geometry (size) and activation levels)

RV Closure Head

Steam Dryer

Steam Separator

Upper Core Grid

Guide Tubes

Core Plate Assembly

Shroud Cylinder

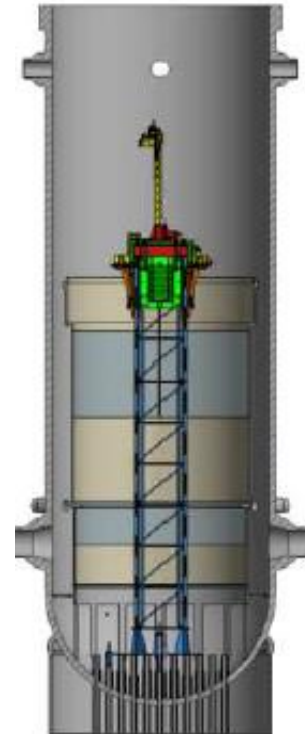
Jet Pump Assemblies

RV Nozzles

Reactor Vessel

Specialized Cutting Equipment

- Water Abrasive Suspension system (WASS MCS)
- Abrasive water jet technology
- Will be used for most of the Vessel segmentation cuts
- 3-D Positioning System



Mast Cutting System (MCS) within Reactor Vessel

RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

Specialized Cutting Equipment

- Water Abrasive Suspension system (WASS PCS)
- Abrasive water jet technology
- Will be used for most of the Vessel segmentation cuts
- 3-D Positioning System



Portal Cutting System (PCS) for segmentation cuts

RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

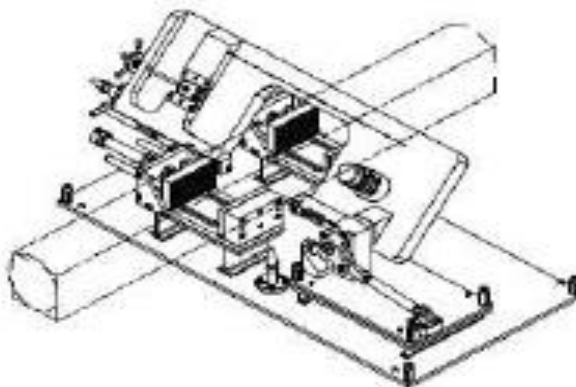
Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

Specialized Cutting Equipment

- Final Segmentation Band Saw (FSBS)
- Mechanical cutting technology
- Used on cylindrical components
- Clamping system to hold components in place



RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

Specialized Cutting Equipment

- Diamond Wire Saw (DWS)
- Mechanical cutting technology
- Used for large and complex geometries with difficult access



RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

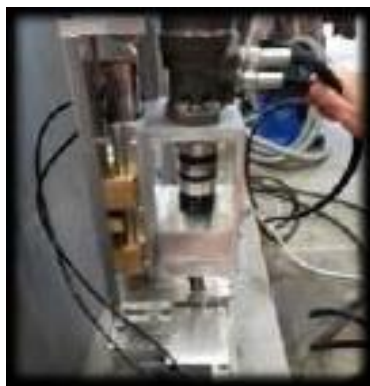
Specialized Cutting Equipment

- Portable cutting tools
- Mechanical cutting technology
- For difficult locations in RV cavity
- Multiple adaptations to tooling

Circular Saw



Hole Saw



Hydraulic Shears



RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

Specialized Cutting Equipment

- Split Lathe Cutter
- Used in many projects
- Highly effective and efficient for cutting medium to smaller diameter nozzles



RV Closure
Head

Steam
Dryer

Steam
Separator

Upper
Core Grid

Guide
Tubes

Core Plate
Assembly

Shroud
Cylinder

Jet Pump
Assemblies

RV
Nozzles

Reactor
Vessel

Empty Spent Fuel Pool



Reactor Vessel Head Removal



VCT, Hi-Track (containing NWFC) and Overpack



Custom Boxes for Packaging

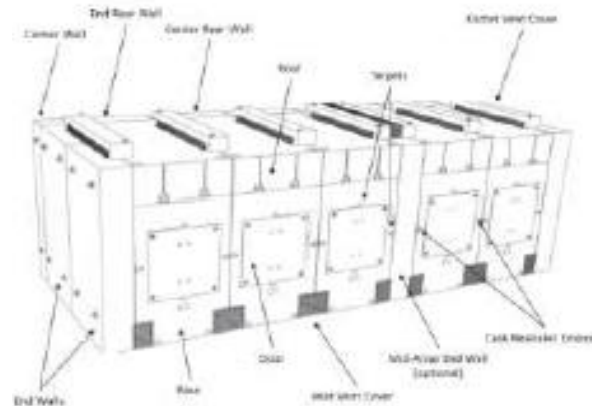
- Photo showing some of the Custom Boxes that have been built and are on-site staged for use

(Segmented pieces are predestined for a specific container based on geometry (size) and activation levels)



Transfer and Shipping

- Horizontal Transfer station (HTS) used to temporarily store materials prior to shipping
- Specialized Transport Cask system for shipment by Rail or Truck



Rail Refurbishment

- Horizontal Transfer station (HTS) used to temporarily store materials prior to shipping
- Rail refurbishment to support shipping and improve efficiency/safety



Rail Utilization

- Horizontal Transfer station (HTS) component(s) arriving on site by rail
- Will be used to temporarily store materials prior to shipping



Demolition of COB (Construction Office Building)



(COB) pad location for Custom Box storage



HTS construction/pad/location



Cooling Towers as of 5/10/2019



Questions?